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ABSTRACT

The study undertook to teach and fix the reading of meaningful symbols (hiragana, the Japanese syllabary alphabet, and kanji, Chinese characters) to a mildly retarded 7 year old Japanese boy. The phonological method was used to teach hiragana and pictures were used to teach kanji. Behavior modification using reinforcement and time out was employed. Results showed that the boy retained 90% of the letters taught by the phonological approach but was unable to retain the kanji numbers because his concept of numbers was as yet unformed. All reinforcement techniques and the time out procedure enhanced learning. Following treatment the boy's behavior changed; he correctly wrote the letters he had acquired, stopped getting out of his seat during class, and stopped crying so easily. (PHR)

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Kaoru Yamaguchi

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I Objective

It is thought that the acquisition of written language in mentally retarded children differs depending on the time the teaching method is introduced. In this study we attempted to teach and fix the reading of meaningful written symbols (hiragana - the Japanese syllabary alphabet, and kanji - Chinese characters*) in a mildly retarded child. We used the phonological method to teach hiragana, and pictures to teach kanji. Our aim was to attempt to modify intellectual behavior mainly by means of operant conditioning.

II Subject

Hide - male; date of birth - July 19, 1968; CA 7 yrs. 9 mos.; in second grade of a regular school.

a) Early childhood - weak suckling power; also showed head banging behavior and had a peculiar voice. An EEG at age 2 showed no abnormality. Tsumori Mental Development Test - CA 3;9 DA 2;10 DQ 76. He attended a special nursery for handicapped children until entering elementary school.

b) Family composition - Mother, Hide, younger brother. Father permanently separated.

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* Each hiragana symbol represents a syllable consisting of either a consonant and a vowel (e.g. ka = か), one of the 5 vowel sounds (e.g. e = え) or the nasal 'n' (ん). In this report the words 'syllable' and 'letter' are used interchangeably to refer to single symbols of the Japanese hiragana syllabary. Kanji are Chinese characters pronounced with one or more syllables.

c) Test results:

Intelligence - Tanaka Binet - CA 7;9 MA 4;0 IQ 52.

Language - simple conversation possible, uses baby talk, articulation disorder in syllables beginning with k-.

Vision, hearing - no abnormality.

Visual perception - no abnormality.

Discrimination, concept formation - same level as mental age.

d) Special Behavioral Characteristics:

doesn't stay in his seat during class, flies a kite or plays in the sand box in the school playground by himself, cries easily, always throwing things, seen to write letter-like symbols and to read them.

e) Letters he can read - three (su, ki, hi), but without meaning.

III Experimental Procedures

a) Experimental period - July 16, 1976 to January 29, 1977.

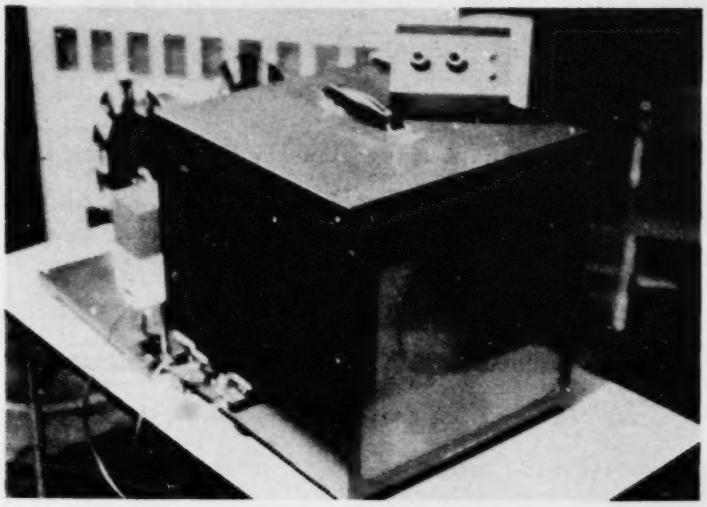
b) Place - Tokyo Gakugei University Research Institute for the Education of Exceptional Children.

c) Experimental situation - a room about 10 m^2. One to one teaching with teacher and Hide. Hide sits in front of a desk the same as the kind used in school and where he can see the reading machine. There is a hiragana chart on the wall in front, a bell-timer to the left, and next to Hide, a token board and a desk on which reinforcements are put.

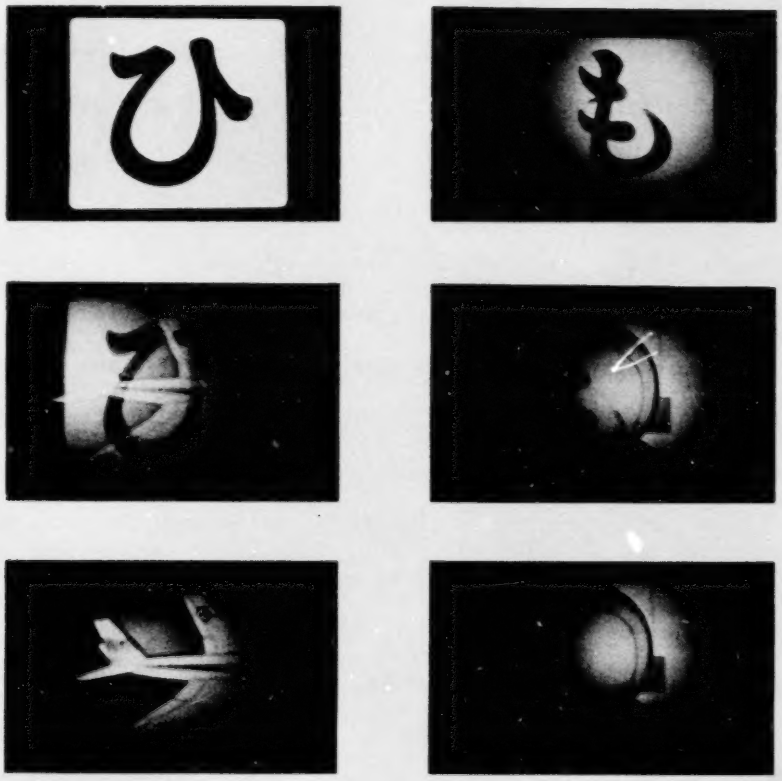
d) Reading machine and teaching aids - A TGY (Tokyo Gakugei University Yamaguchi-type) reading machine was used (Picture 1). Two projectors are combined in one and either a letter or a picture or an overlap of the two can be projected. In addition, one can control the level of darkness and lightness of the letters and pictures. First, a letter is projected onto the screen and the subject looks at it but cannot read it. Then a picture that serves as a clue to read the letter is projected over it (Picture 2). As this procedure is repeated, the picture is faded out and the subject begins to read the letter without the clue. Each time the subject

reads the letter correctly, he is reinforced by a light and buzzer.

Picture 1



Picture 2



The slides used were pictures that Hide could recognize, things represented by single or several hiragana (syllable) sounds, kanji, and pictures to bring out the representational (e.g. 山 means mountain) or indicative (上 means up) form of kanji which serve as clues for reading the kanji.

We tried to generalize learning visually by presenting in order magnified letters on a screen (big), letters from slides (medium) and hand-made cards (small).

e) Program for presenting the letters - Table 1 shows the order in which the hiragana were presented. We made our starting point the reading of 'su', 'ki', and 'hi' as Hide could already match the sound with the symbol, although without special meaning. Next, we added the letters of his name and the 50 letters of the Japanese alphabet taking into special consideration his problem with articulation of k- sounds. When he reached the level of being able to read 20 letters we introduced words which contained more than one symbol. We did this to repeat what was learned and also to ascertain whether use of the phonological approach which teaches isolated syllables can also teach the child to read and understand words of several syllables. We also tried presenting words with changes such as 'a-shi'(foot), 'a-o' (blue), and 'a-ka' (red). Then we turned in order to the teaching of particles such as 'o' (indicating direct object), two more letters of Hide's name ('de' and 'ga'), and the nasal 'n'.

Table 2 shows the program for presentation of kanji. Kanji were presented in the order of greatest recognizability by regular elementary school children as determined in a study by the Japanese Language Research Institute (1972). We also tried presenting kanji that would bring out Hide's interest. We omitted kanji representing numbers except for 4 (四) and 10 (十) as his concept of number had not yet been formed. The kanji in boxes in Table 2 are those that were taught.

Table 1

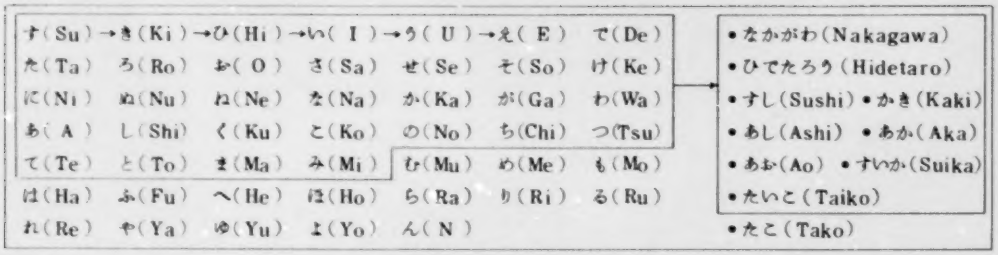
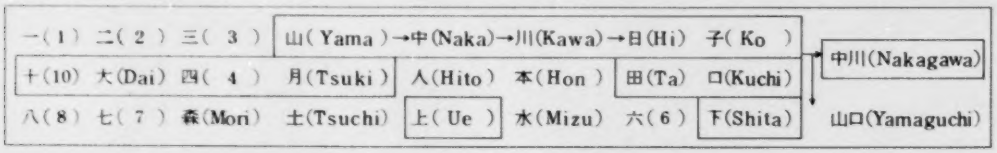

す(Su)→き(Ki)→ひ(Hi)→い(I)→う(U)→え(E) で(De)
た(Ta) ろ(Ro) お(O) さ(Sa) せ(Se) そ(So) け(Ke)
に(Ni) ぬ(Nu) ね(Ne) な(Na) か(Ka) が(Ga) わ(Wa)
あ(A) し(Shi) く(Ku) と(Ko) の(No) ち(Chi) つ(Tsu)
て(Te) と(To) ま(Ma) み(Mi) む(Mu) め(Me) も(Mo)
は(Ha) ふ(Fu) へ(He) ほ(Ho) ら(Ra) り(Ri) る(Ru)
れ(Re) や(Ya) ゆ(Yu) よ(Yo) ん(N)
• なかがわ(Nakagawa)
• ひでたろう(Hidetaro)
• すし(Sushi) • かき(Kaki)
• あし(Ashi) • あか(Aka)
• あお(Ao) • すいか(Suika)
• たいこ(Taiko)
• たこ(Tako)

Table 2


一(1) 二(2) 三(3) 山(Yama)→中(Naka)→川(Kawa)→日(Hi) 子(Ko)
十(10) 大(Dai) 四(4) 月(Tsuki) 人(Hito) 本(Hon) 田(Ta) 口(Kuchi)
八(8) 七(7) 森(Mori) 土(Tsuchi) 上(Ue) 水(Mizu) 六(6) 下(Shita)
中川(Nakagawa)
山口(Yamaguchi)

f) Observation - the observation room was located behind a one-way mirror equipped with headphones used by 2 or more observers. Data were recorded on special sheets using symbolic and concrete symbols for the following categories - correct responses, conditions-attached correct responses (e.g. clues were given, etc.), and incorrect responses. Further, depending on the total data collected, we could ascertain what had been learned thusfar and what had been accomplished in the previous session. Thus we could better consider how to proceed at Hide's own pace.

g) Reinforcement procedures - contingent on correct responses

i) immediate reinforcement by turning on the teaching machine's light and buzzer.

ii) token reinforcement by giving him magnetic tokens and having him put them on a board. For every 5 tokens we let him choose one exchange back-up reinforcement (e.g. cards, chocolate, etc.).

iii) social reinforcement from the teacher (e.g. praising, patting the head, etc.).

Further, since we expected refusal to learn behavior, we decided to attempt to modify this by the joint application of extinction and "time-out". We decided to take away one positive reinforcement from the reinforcement machine and put Hide in a dimly lit room next to the study room whenever he refused to study.

Consecutive study time goals were determined by the amount of time we thought Hide could achieve, starting at 20 minutes and gradually increasing consecutive study time by one minute per session until we reached the final goal of 30 minutes.

IV Results

The experiment produced the results shown in the figures (1 and 2) and was carried out under the following three conditions.

Stage 1: Reinforcement by light and buzzer, token and social reinforcement (13 sessions).

Stage 2: The same conditions in Stage 1 plus the use of "time-out" and the setting up of a consecutive study time goal (16 sessions).

Stage 3: Without reinforcement (no exchange for tokens) (3 sessions).

Stage 4: Same as Stage 2 (3 sessions).

The changes in consecutive study time are shown in Figure 1. The cumulative record of acquired letters and retention is shown in Figure 2.

Figure 1

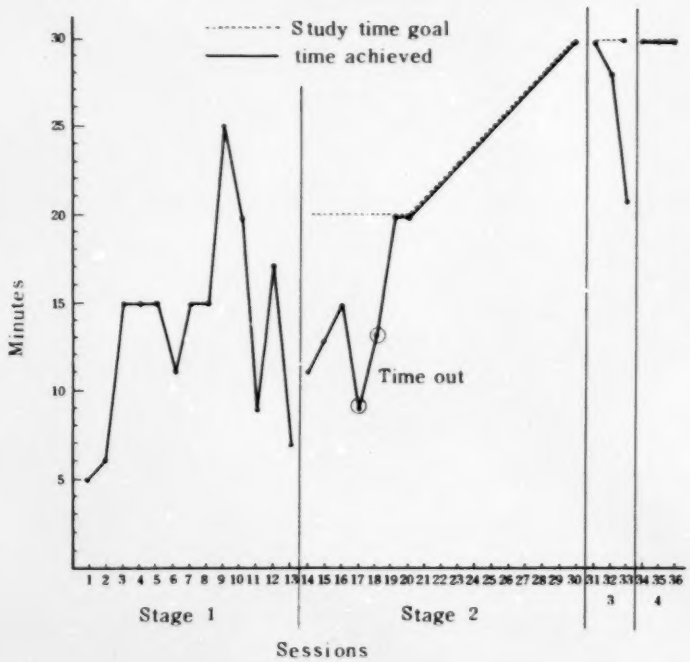
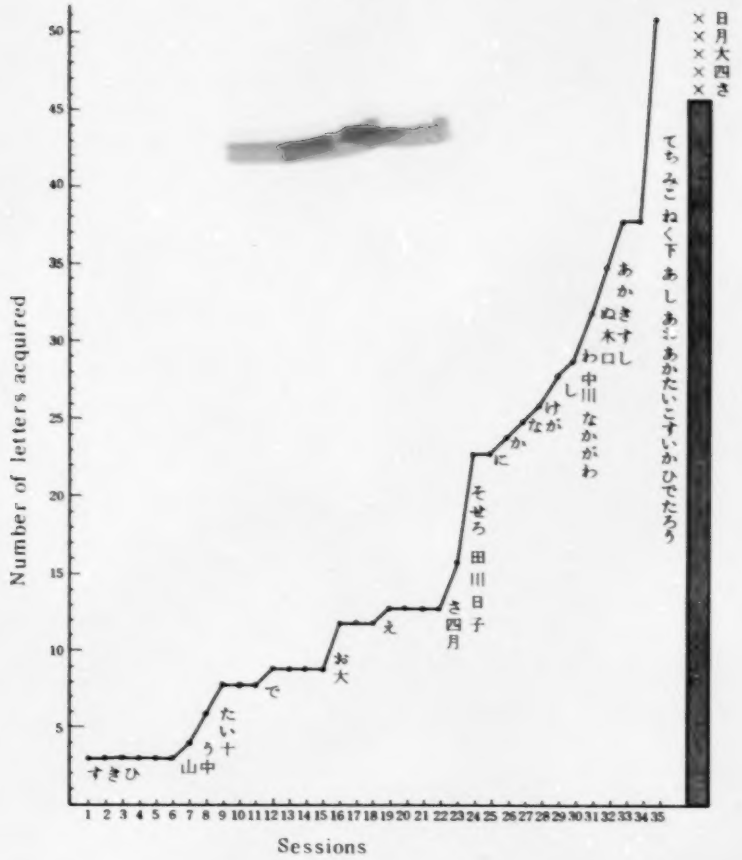


Figure 2



1) Experimental Stage 1 - We presented 12 letters according to the program. We ended the session when Hide repeated the task 4 times or when he insisted on stopping even though we encouraged him to continue. As you can see in Figure 1, consecutive study time started at 5 minutes and increased to a high of 25 minutes. But on the whole it was unstable and the ups and downs were quite marked from the 10th session on.

Also, as Hide's learning was stalled at 7 letters at this stage, we entered into Experimental Stage 2 to lengthen the consecutive study time.

2) Experimental Stage 2:

a) Whenever Hide would say "stop", the lesson ended, but we would enforce "time-out" in the room without letting him leave.

b) We set up a goal for consecutive study time. We started at 20

minutes because we thought it could be reasonably achieved as Hide had studied spontaneously for up to 25 minutes in Experimental Stage 1. We then increased the length of each session by one minute until we reached the goal of 30 minutes. A bell timer was used to automatically signal the end of the session.

As we expected, the lesson was suspended in sessions 14-16, and we had "time-out" in the room. But Hide didn't care to leave the room, he just spent the time humming and yawning. We thought this might be because Hide was used to playing without friends by himself in school.

c) So, as a next step, we introduced the type of time-out where whenever we stopped the lesson, Hide was put into a dimly lit room next door. In the 17th session Hide called out "stop" at 9 minutes and the above-mentioned time-out was put into effect. After he was put in the dimly lit room, he sat down in the sofa and waited quietly, but after 5 minutes he cried "It's scary !". In the 18th session the lesson was suspended at 13 minutes and as soon as Hide was put into the room he began to cry. In the 19th session he continued on for the time set for the session. After that he called "stop" twice, but decided to continue studying until the end of the time set for the session when the teacher asked "Do you want to stop studying and go to the next room?". After the 19th session, the time set for each lesson was increased by one minute per session until the goal of 30 minutes was reached in the 30th session.

His acquisition of letters doubled to 19 compared to the number from Stage 1.

3) Experimental Stage 3: We verified the effectiveness of the token positive reinforcer. We went into a teaching situation the same as in Stages 1 and 2, removing only the exchange of tokens. Hide repeatedly yawned and said "This is a bore" and finally just lay face down on the desk. Along with the collapse of his attitude toward studying, the

continuous study time dropped to 27 and 19 minutes. This supports the thesis that the reinforcer was effective. In this stage "time-out" was not used.

4) Experimental Stage 4: We returned to the same conditions as in Stage 2. Hide studied diligently and easily achieved the goal of 30 minutes consecutive study time. Further, in the 35th session, after receiving a kite as a reward for a test we established for learning retention, he voluntarily returned the other things he had received in exchange for tokens. The next time, we had him choose between token exchange and kite flying and he chose kite flying. So after that, we used kite flying after studying as a positive reinforcer in place of token exchange.

5) Test for Learning Retention: To promote generalization we used 2 kinds of cards instead of relying on the learning machine. The letters which we used for retention test problems were those we believed Hide had learned as he showed correct responses in consecutive sessions 3-4.

V Discussion

1) Effectiveness of the phonological approach

We had thought that teaching Hide reading might be a little premature as it was thought he only had the ability to analyze ayllables at a level of less than 4 years. The results of 35 teaching sessions showed a reading retention of 46 letters (including words and kanji), a rate of 90% of the 51 letters he had learned. He recognized 100% of the words. It can be thought that the phonological method is effective for teaching hiragana to mentally handicapped children.

Also, we saw absolutely no confusion in the reading of words like 'a-shi', 'a-o', 'a-ka' or 3-syllable words, a worry in the phonological teaching method

2) Reading of number kanji

We also tried teaching number kanji. It was difficult for him to

learn "1,2,3" but '4' was acquired although not retained. In general, number kanji were difficult because Hide's concept of number was not yet formed. We think tentatively that the learning of '4' was possible, but because he learned it by shape, he did not retain it.

3) Application of operant conditioning

a) The pictures which serve as reading clues in the learning machine can be presented in accordance with the child's responses. We think that learning effectiveness was heightened by the application of the operant principle of fading out clues such that the image reflected was clear when the child did not understand at all and weak when the child was beginning to understand. It is possible to use this method for many purposes, not only the studying of reading.

b) Reinforcement: First, we can confirm from the child's behavior that the light and buzzer set-up in the teaching machine provided immediate reinforcement as he demanded quick sounding of the buzzer. Also, the back-up reinforcement system which included chocolate, balloons, tops, etc. brought about good results in Hide's play behavior. This then led to kite flying itself as being the most effective reinforcer.

4) We can say that the desirable change in consecutive study time shown in Figure 1 is due to the efficacy of "time-out" in Stage 2. We put Hide into the dimly lit room only twice in sessions 17 and 18, but after that just the mention of "time-out" worked. Further, we can say that advancing the bell timer one minute at a time gave rise to the desirable result of enabling us to continue the study time to the end goal.

5) In the cumulative graph of acquired letters we can see a remarkable rise from session 22 on. This corresponds to the third time we achieved the consecutive study time goal. Thus it appears that there is a relationship between consecutive study time and learning effectiveness.

6) The joint conclusion reached by the teacher in charge, Hide's mother and the authors is that a notable change occurred in Hide's

behavior at school. For example, he stopped going outside to play and leaving his seat during class, correctly wrote the letters he had acquired in the margin of his notebook, and stopped crying so easily.

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